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Analysis of Cyclic Elastic-Plastic Loading of Shaft Based on Kinematic Hardening Model

Authors : Isa Ahmadi, Ramin Khamedi

Abstract : In this paper, the elasto-plastic and cyclic torsion of a shaft is studied using a finite element method. The Prager kinematic hardening theory of plasticity with the Ramberg and Osgood stress-strain equation is used to evaluate the cyclic loading behavior of the shaft under the torsional loading. The material of shaft is assumed to follow the non-linear strain hardening property based on the Prager model. The finite element method with C1 continuity is developed and used for solution of the governing equations of the problem. The successive substitution iterative method is used to calculate the distribution of stresses and plastic strains in the shaft due to cyclic loads. The shear stress, effective stress, residual stress and elastic and plastic shear strain distribution are presented in the numerical results.

Keywords : cyclic loading, finite element analysis, Prager kinematic hardening model, torsion of shaft
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